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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: D.P.D. Piponi, et al.	Art Unit: 2128
Serial No.: 10/715,778	
Filed: November 17, 2003	Examiner: Cuong V. Luu
Title: METHOD FOR MOTION SIMULATION OF AN ARTICULATED FIGURE USING ANIMATION INPUT	

DECLARATION OF OLIVER JAMES UNDER 37 C.F.R. § 1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I, Oliver James, declare that:

1. I am an original inventor of the subject matter disclosed in the U.S. patent application Serial No. 10/715,778, filed November 17, 2003.

2. I have reviewed the pending claims attached hereto in EXHIBIT A. Claim 1 encompasses a method for determining movements of an articulated figure for use in computer-generated animation, used for visual effects in the motion picture The Matrix Reloaded, in which, the motion of an animated figure is modeled using a sum of external forces and internal joint torques obtained by

inverse dynamics from motion capture data. Claim 8 depends on claim 1, and further defines calculating the external force data *G(t)* using *P(t)* – the dynamic response of the modeled figure – as input to determine collision events between the articulated figure and other simulated objects, to determine impulse values for *G(t)*. Claims 11 and 18, respectively, encompass a computer-readable medium encoded with instructions for performing the methods encompassed by claim 1 and 8.

3. The methods and computer-readable media encompassed by claims 1, 8, 11 and 18, and possibly other claims of the pending application, were reduced to practice by me and my co-inventors no later than June 8, 2002. The methods and computer-readable media were used in the making of the movie The Matrix Reloaded.

4. I know that the claimed techniques were reduced to practice no later than June 8, 2002, because on that date I produced a QuickTime™ demonstration clip showing a successful implementation of the claimed techniques. This demonstration clip has the June 8, 2002 date burnt in. This date is consistent with my own recollections of when the claimed techniques were implemented and tested. A copy of the June 8, 2002 video clip, saved as a QuickTime™ file dated June 10, 2002 and named "devDYNGUY_anim_torquefeedback_001 copy" is provided on the enclosed CD-ROM disc. This file may be played using a widely-available Apple™ QuickTime™ player, demonstrating operability of the claimed method.

5. The demonstration clip shows two versions of a simulation. On the left side, an animated figure without the claimed torque feedback is shown. On the right side, an animated figure is shown, modeled using the claimed torque feedback method. Both versions are the same up to frame 20, prior to which both figures

are animated using motion capture data only. After this frame, the left hand reacts to an impulse force from collision with a massive ball in a passive fashion, without torque feedback. In the right hand figure, the claimed algorithm was used to apply torques to the joints, simulating muscle activation attempting to continue the motion-captured movement while at the same time reacting to the same impulse force as the left hand figure. The effect of modeling the animated figure using a sum of F(t) – the external collision force – and G(t) – the joint torques obtained by inverse dynamics from motion capture data – is clearly visible by comparison between the two figures.

6. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Oliver James

Oliver James

November 6th 2008

Date

EXHIBIT A

SELECTED PENDING CLAIMS

1. A method for determining movements of an articulated figure for use in computer-generated animation, the method comprising:

accessing a pose sequence $Q(t)$, wherein $Q(t)$ comprises position values associated with segments of an articulated figure at sequential times of the pose sequence;

calculating an inverse-dynamics solution $F(t)$, wherein $F(t)$ comprises calculated torque values for the segments during sequential forward-looking intervals Δt, such as would result in movements of the articulated figure corresponding to $Q(t)$;

accessing force data $G(t)$, wherein $G(t)$ comprises time-varying external force values for simulating a response of the articulated figure;

simulating a dynamic response of the articulated figure in reaction to a sum of $F(t)$ and G(t), thereby defining a simulated pose sequence $P(t)$; and

providing the simulated pose sequence $P(t)$ to a computer for use in animating an articulated figure.

8. The method of Claim 1, further comprising calculating $G(t)$ using $P(t)$ as input to determine collision events between the articulated figure and other simulated objects, whereby impulse values for $G(t)$ are determined.

EXHIBIT A (Continued)

11. A computer-readable medium encoded with instructions for determining movements of an articulated figure for use in computer-generated animation, the instructions comprising:

accessing a pose sequence *Q(t)*, wherein *Q(t)* comprises position values associated with segments of an articulated figure at sequential times of the pose sequence;

calculating an inverse-dynamics solution *F(t)*, wherein *F(t)* comprises calculated torque values for the segments during sequential forward-looking intervals Δt, such as would result in movements of the articulated figure corresponding to Q(t);

accessing force data *G(t)*, wherein *G(t)* comprises time-varying external force values for simulating a response of the articulated figure; and

providing a sum of *F(t)* and *G(t)* suitable for input in simulating a dynamic response of the articulated figure using a forward-dynamics motion simulation to determine a simulated pose sequence *P(t)*.

18. The computer-readable media of Claim 13, wherein the instructions further comprise calculating *G(t)* using *P(t)* as input to determine collision events between the articulated figure and other simulated objects, whereby impulse values for *G(t)* are determined.